

REMARKS:

Applicant Acknowledges that the Examiner has maintained the restriction requirement.

Foreign Priority

The acknowledgement, in the Office Action, of a claim for foreign priority under 35 U.S.C. § 119(a)-(d), and that the certified copy of the priority document has been received, is noted with appreciation.

Status Of Application

Claims 1-26 were pending in the application; the status of the claims is as follows:

Claims 7-16 are withdrawn from consideration.

Claims 1, 2, 6, 17, 18, 23, and 24 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,783,899 to Okazaki (hereinafter the “Okazaki Patent”).

Claims 1-3, 5, 17, 18, and 23-25 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,319,278 to Myohga et al (hereinafter the “Myohga Patent”).

Claims 4 and 26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over either the Okazaki Patent or the Myohga Patent in view of U.S. Patent No. 5,969,464 to Nakano (hereinafter the “Nakano Patent”).

Claim 5 is rejected under 35 U.S.C. § 103(a) as being unpatentable over the Okazaki Patent in view of U.S. Patent No. 5,210,454 to Naito (hereinafter the “Naito Patent”).

Claims 19 and 20 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the Okazaki Patent.

Claims 3 and 25 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the Okazaki Patent in view of the Myohga Patent.

Claims 19-21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the Myohga Patent.

Claim 22 is rejected under 35 U.S.C. § 103(a) as being unpatentable over either of the Okazaki Patent or the Myohga Patent in view of the Nakano Patent.

Drawings

To date, no Notice of Draftsperson's Patent Drawing Review has been received. Applicants respectfully request receipt of this document when it becomes available. Please note that the original drawings filed in the patent application are "formal" drawings.

Claim Amendments

Claims 1-6 and 17-26 have been amended to correct grammatical errors and other errors of form.

35 U.S.C. § 102(b) Rejections

Okazaki Patent

The rejection of claims 1, 2, 6, 17, 18, 23, and 24 under 35 U.S.C. § 102(b) as being anticipated by the Okazaki Patent, is respectfully traversed based on the following.

The Okazaki Patent shows a piezoelectric driven motor system. Piezoelectric devices 12, 13, 14 and 15 are mounted on a deformable substrate 11 (Figure 3). The piezoelectric devices are polarized in a direction toward the substrate (see Figure 4(C)

and column 5, line 54 through column 6, line 3). The output of a first waveform generator 24 and a second waveform generator 22 are connected at opposite ends of piezoelectric device 12 with the direction of polarization of piezoelectric device 12 being perpendicular to the field generated therebetween. As best as can be discerned from the Okazaki Patent, the connections to piezoelectric device 12 are both on the surface of piezoelectric device 12 opposite from the substrate.

The signal from the first waveform generator is inverted in polarity by inverter 25 and applied to one end of piezoelectric device 13. The signal from the second waveform generator is phase shifted by phase converter 23 and applied to the opposite end of piezoelectric device 13. Also, the signal from the first waveform generator is applied to piezoelectric device 14 and the signal from the polarity inverter 25 is applied to piezoelectric device 15. The signals applied to the piezoelectric devices induce movement in substrate 11 that is delivered via legs 11b and 11c. Of importance, the connections of the driving signals are all applied to a single surface of each piezoelectric device.

In contrast to the prior art, claim 1 provides:

A driving apparatus for driving a piezoelectric element serving as a driving source of an actuator comprising:
a waveform generator for generating a waveform signal varying over time;

a first driver for generating a *first driving signal*, wherein the first driving signal has a maximum voltage smaller than a voltage of inversion of polarization of the piezoelectric element and *has a waveform derived from the waveform signal*, the first driver being coupled to provide the first driving signal to the piezoelectric element *in the polarization direction of the piezoelectric element*; and

a second driver for generating a *second driving signal*, wherein said second driving signal has a maximum voltage smaller than the voltage of inversion of polarization of the piezoelectric element and *has a waveform derived from the waveform signal*, the second driver being coupled to provide the second driving signal to the piezoelectric element *in a direction opposite to the polarization direction*.

(Emphasis Added.)

Thus, signals derived from a single waveform source are applied to opposing polarities of the piezoelectric element. This provides an effect on the piezoelectric device equivalent to that of a signal having double the amplitude of the signals actually applied (Figure 4D and specification page 12 line 15 through page 13, line 7). This is particularly important in the circumstance where, using prior techniques, a double voltage would cause repolarization of the piezoelectric device.

In the Okazaki Patent, all of the signals are connected on the same surface of each piezoelectric element and thus are all applied in one direction of polarity. In addition, each piezoelectric device in the Okazaki Patent receives only one signal from either signal source (wave form generators 22 and 24). On the other hand, both driving signals of claim 1 are derived from one waveform generator. This maximizes the doubling effect. In summary, the Okazaki Patent does not show or suggest the elements of claim 1. Therefore, the Okazaki Patent also does not show or suggest all of the elements of dependent claims 2 and 6. Thus, Okazaki does not anticipate claims 1, 2 and 6.

Both claims 17 and 23 require that first and second driving signals be applied to a piezoelectric element in opposite directions of polarity of the piezoelectric device. As explained above, all signals in the Okazaki Patent are applied to the piezoelectric devices (12-15) on a single surface and thus in a single direction of polarity. Therefore, the Okazaki Patent does not show or suggest every element of claims 17 and 23. Claims 18 and 24 depend from claims 17 and 23, respectively. Therefore, the Okazaki Patent does not show or suggest every element of claims 18 and 24. Thus, the Okazaki Patent does not anticipate claims 17, 18, 23 and 24. Therefore, claims 1, 2, 6, 17, 18, 23, and 24 are patentably distinct from the cited prior art.

Accordingly, it is respectfully requested that the rejection of claims 1, 2, 6, 17, 18, 23, and 24 under 35 U.S.C. § 102(b) as being anticipated by the Okazaki Patent, be reconsidered and withdrawn.

Myohga Patent

The rejection of claims 1-3, 5, 17, 18, and 23-25 under 35 U.S.C. § 102(b) as being anticipated by the Myohga Patent, is respectfully traversed based on the following.

Claims 1, 17 and 23 require that first and second driving signals that are applied to a piezoelectric element in the direction of polarity of the piezoelectric element (first driving signal) and in the direction opposite of the polarity of the piezoelectric element (second driving signal). The Myohga Patent does not discuss the polarity of the piezoelectric elements and does not show how the signals from phase shifter 53 and driver 51 are applied to the piezoelectric elements (longitudinal vibrator 32 and torsional vibrator 35). Therefore, Myohga does not show or suggest every element of claims 1, 17 and 23. Claims 2, 3 and 5 are dependent from claim 1. Claim 18 is dependent from claim 17. Claims 24 and 25 are dependent from claim 23. Thus, the Myohga Patent does not show or suggest every element of claims 2, 3, 5, 18, 24 and 25. Therefore, claims 1-3, 5, 17, 18, and 23-25 are patentably distinct from the prior art.

Accordingly, it is respectfully requested that the rejection of claims 1-3, 5, 17, 18, and 23-25 under 35 U.S.C. § 102(b) as being anticipated by the Myohga Patent, be reconsidered and withdrawn.

35 U.S.C. § 103(a) Rejections

The rejection of claims 4 and 26 under 35 U.S.C. § 103(a), as being unpatentable over either the Okazaki Patent or the Myohga Patent in view of the Nakano Patent, is respectfully traversed based on the following.

Claims 4 and 26 are dependent from Claims 1 and 23, respectively. As noted above, neither the Okazaki Patent nor the Myohga Patent show or suggest coupling drivers to provide signals both in the direction of polarization of the piezoelectric device and in the opposite direction of polarization of the piezoelectric device. The

Nakano Patent shows the use of a sawtooth wave in driving piezoelectric elements, but does not show or suggest coupling drivers to provide signals both in the direction of polarization and in the opposite direction of polarization. Therefore, the cited prior art does not show or suggest every element of claims 4 and 26. Thus, claims 4 and 26 are patentably distinct from the prior art.

Accordingly, it is respectfully requested that the rejection of claims 4 and 26 under 35 U.S.C. § 103(a), as being unpatentable over either the Okazaki Patent or the Myohga Patent in view of the Nakano Patent, be reconsidered and withdrawn.

The rejection of claim 5 under 35 U.S.C. § 103(a), as being unpatentable over the Okazaki Patent in view of the Naito Patent, is respectfully traversed based on the following.

Claim 5 is dependent from Claim 1. As noted above, the Okazaki Patent does not show or suggest coupling drivers to provide signals both in the direction of polarization of the piezoelectric device and in the opposite direction of polarization of the piezoelectric device. The Naito Patent shows the use of amplifiers as drivers, but does not show or suggest coupling the drivers to provide signals both in the direction of polarization and in the opposite direction of polarization. Therefore, the cited prior art does not show or suggest every element of claim 5. Thus, claim 5 is patentably distinct from the prior art.

Accordingly, it is respectfully requested that the rejection of claim 5 under 35 U.S.C. § 103(a), as being unpatentable over the Okazaki Patent in view of the Naito Patent, be reconsidered and withdrawn.

The rejection of claims 19 and 20 under 35 U.S.C. § 103(a), as being unpatentable over the Okazaki Patent, is respectfully traversed based on the following.

Claims 19 and 20 depend from Claim 17. As noted above, the Okazaki Patent does not show or suggest every element of claim 17, and thus does not show every

element of claims 19 and 20. The rejection indicates that the limitations of claims 19 and 20 are goals that do not provide structural limitation. Applicant respectfully disagrees. Claims 19 and 20 add limitations to the electrical characteristics of the driver circuitry. Thus, these limitations do define additional physical limitations in the behavior of the claimed apparatus. For these reasons, claims 19 and 20 are patentably distinct from the cited prior art.

Accordingly, it is respectfully requested that the rejection of claims 19 and 20 under 35 U.S.C. § 103(a), as being unpatentable over the Okazaki Patent, be reconsidered and withdrawn.

The rejection of claims 3 and 25 under 35 U.S.C. § 103(a), as being unpatentable over the Okazaki Patent in view of the Myohga Patent, is respectfully traversed based on the following.

As noted above, neither the Okazaki Patent nor the Myohga Patent show or suggest coupling drivers to provide signals both in the direction of polarization of the piezoelectric device and opposite the direction of polarization of the piezoelectric device as provided in Claims 1 and 23. Claims 3 and 25 depend from claims 1 and 23, respectively. Therefore, the cited references do not show or suggest every element of claims 3 and 25. Thus, claims 3 and 25 are patentably distinct from the prior art.

Accordingly, it is respectfully requested that the rejection of claims 3 and 25 under 35 U.S.C. § 103(a), as being unpatentable over the Okazaki Patent in view of the Myohga Patent, be reconsidered and withdrawn.

The rejection of claims 19-21 under 35 U.S.C. § 103(a), as being unpatentable over the Myohga Patent, is respectfully traversed based on the following.

Claims 19-21 depend from Claim 17. As noted above, the Myohga Patent does not show or suggest every element of claim 17, and thus does not show every element of claims 19-21. The rejection indicates that the limitations of claims 19-21

are goals that do not provide structural limitation. Applicant respectfully disagrees. Claims 19-21 add limitations to the electrical characteristics of the driver circuitry. Thus, these limitations do define additional physical limitations in the behavior of the claimed apparatus. For these reasons, claims 19-21 are patentably distinct from the cited prior art.

Accordingly, it is respectfully requested that the rejection of claims 19-21 under 35 U.S.C. § 103(a), as being unpatentable over the Myohga Patent, be reconsidered and withdrawn.

The rejection of claim 22 under 35 U.S.C. § 103(a), as being unpatentable over either the Okazaki Patent or the Myohga Patent in view of the Nakano Patent, is respectfully traversed based on the following.

As noted above, neither the Okazaki Patent, Nakano Patent nor the Myohga Patent show or suggest coupling drivers to provide signals both in the direction of polarization of the piezoelectric device and in the opposite direction of polarization of the piezoelectric device as provided in Claim 17. Claim 22 depends from claim 17. Thus, the combination of the Okazaki or Myohga Patents with the Nakano Patent does not show or suggest every element of claim 22. Therefore, claim 22 is patentably distinct from the prior art.

Accordingly, it is respectfully requested that the rejection of claim 22 under 35 U.S.C. § 103(a), as being unpatentable over either the Okazaki Patent or the Myohga Patent in view of the Nakano Patent, be reconsidered and withdrawn.

CONCLUSION

Wherefore, in view of the foregoing amendments and remarks, this application is considered to be in condition for allowance, and an early reconsideration and a Notice of Allowance are earnestly solicited.

This Amendment does not increase the number of independent claims, does not increase the total number of claims, and does not present any multiple dependency claims. Accordingly, no fee based on the number or type of claims is currently due. However, if a fee, other than the issue fee, is due, please charge this fee to Sidley & Austin Deposit Account No. 18-1260.

If an extension of time is required to enable this document to be timely filed and there is no separate Petition for Extension of Time filed herewith, this document is to be construed as also constituting a Petition for Extension of Time Under 37 C.F.R. § 1.136(a) for a period of time sufficient to enable this document to be timely filed. Any other fee required for such Petition for Extension of Time and any other fee required by this document pursuant to 37 C.F.R. §§ 1.16 and 1.17, other than the issue fee, and not submitted herewith should be charged to Sidley & Austin Deposit Account No. 18-1260. Any refund should be credited to the same account.

Respectfully submitted,

By:


Douglas A. Sorensen
Registration No. 31,570
Attorney for Applicant

DAS/lr
SIDLEY & AUSTIN
717 N. Harwood
Suite 3400
Dallas, Texas 75201
Direct: (214) 981-3482
Main: (214) 981-3300
Facsimile: (214) 981-3400
April 18, 2001

APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

The following is a marked-up version of the changes to the claims which are being made in the attached response to the Office Action dated March 16, 2001.

IN THE SPECIFICATION:

Line 25 of page 3 and replace with the following.

[SUMMERY OF THE INVENTION]

SUMMARY OF THE INVENTION

IN THE CLAIMS:

1. (Once Amended) A driving apparatus for driving a piezoelectric element [device] serving as a driving source of an actuator comprising:
a waveform generator for generating a waveform signal varying [corresponding to passage of] over time;
a first driver for generating a first [voltage] driving signal, wherein the first driving signal has [having] a maximum voltage smaller than a voltage of inversion of polarization of the piezoelectric element and has a waveform derived from the waveform signal, the first driver being coupled to provide [device by using the signal from the waveform generator, and for applying] the first [voltage] driving signal to the piezoelectric element [device] in the polarization direction of the piezoelectric element; and
a second driver for generating a second [voltage] driving signal, wherein said second driving signal has [having] a maximum voltage smaller than the voltage of inversion of polarization of the piezoelectric element and has a waveform derived from the waveform signal, [device and the same polarity as that of the first driving signal by using the signal from the waveform generator, and for applying] the second

driver being coupled to provide the second [voltage] driving signal to the piezoelectric element [device] in a direction opposite to the polarization direction.

2. (Once Amended) [The]A driving apparatus in accordance with claim 1, wherein the second driving signal has a waveform which is an inversion of a waveform of the first driving signal.

3. (Once Amended) [The]A driving apparatus in accordance with claim 1, wherein the [waveform] waveforms of the first and second driving signals are [a] sine [wave.] waves.

4. (Once Amended) [The]A driving apparatus in accordance with claim 1, wherein the [waveform] waveforms of the first and second driving signals are [a] sawtooth [wave] waves in which the inclination in a rising [up] portion is different from that in a falling [down] portion.

5. (Once Amended) [The]A driving apparatus in accordance with claim 1, wherein the first driver and the second driver respectively [includes] include an amplifier for amplifying the signal from the waveform generator.

6. (Once Amended) [The]A driving apparatus in accordance with claim 1, wherein the actuator is an impact type actuator comprising a first unit with the piezoelectric element [device] and a second unit slidably held on and relatively movable against the first unit.

17. (Once Amended) A driving apparatus for driving a piezoelectric element [device] serving as a driving source of an actuator comprising:
a first driver for applying a [voltage] first driving signal to the piezoelectric element [device] in a polarization direction thereof; and
a second driver for applying a [voltage] second driving signal to the piezoelectric element [device] equal to or smaller than a voltage of inversion of polarization of the piezoelectric element [device] in a direction opposite to the polarization direction.

18. (Once Amended) [The]A driving apparatus in accordance with claim 17 further comprising [a] an electric power supply for supplying electric power to the first and second drivers.

19. (Once Amended) [The]A driving apparatus in accordance with claim 17 further comprising a waveform generator for generating a time varying signal [varying corresponding to the passage of time], and wherein

only the first driver applies [a] the first driving signal [voltage] corresponding to the waveform of the time varying signal when the time varying signal [from the waveform generator] is larger than a predetermined level; and

both of the first and second driving signals [driver respectively apply voltages corresponding] correspond to the [waveform of the] time varying signal when the time varying signal [from the waveform generator] is smaller than the predetermined level.

20. (Once Amended) [The]A driving apparatus in accordance with claim 19, wherein the first and second driving signals [voltages outputted from the first and second driver] are 0V when the time varying signal [from the waveform generator] is equal to the predetermined level.

21. (Once Amended) [The]A driving apparatus in accordance with claim 19, wherein the [waveform] waveforms of the first and second driving signals are [a] sine [wave] waves.

22. (Once Amended) [The]A driving apparatus in accordance with claim 19, wherein the [waveform] waveforms of the first and second driving signals are [a] sawtooth [wave] waves in which the inclination in a rising [up] portion is different from that in a falling [down] portion.

23. (Once Amended) A method for driving an actuator having a piezoelectric element [device] serving as a driving source characterized by that:
a first driving signal having a maximum voltage smaller than a voltage of

inversion of polarization of the piezoelectric element [device] is applied to the piezoelectric element [device] in a polarization direction; and

a second driving signal having the same voltage but the inverted polarization is applied to the piezoelectric element [device] in a direction opposite to the polarization direction of the piezoelectric element.

24. (Once Amended) [The]A method in accordance with claim 23, wherein the second driving signal has a waveform which is an inversion of a waveform of the first driving signal.

25. (Once Amended) [The]A method in accordance with claim 23, wherein the [waveform] waveforms of the first and second driving signals are [a] sine [wave.] waves.

26. (Once Amended) [The]A method in accordance with claim 23, wherein the [waveform] waveforms of the first and second driving signals are [a] sawtooth [wave] waves in which the inclination in a rising [up] portion is different from that in a falling [down] portion.